Vol. 1-8


# PAVING AND MUNICIPAL ENGINEERING.

A Journal Devoted Specially to Street and Sidewalk Paving, Water Works Construction, Bridge Building, Street Lighting, Sewerage and all Matters Pertaining to Public Improvement in Cities.

ONE DOLLAR A YEAR IN ADVANCE. INDIANAPOLIS, IND., JANUARY, 1891. SINGLE COPIES, TEN CENTS.

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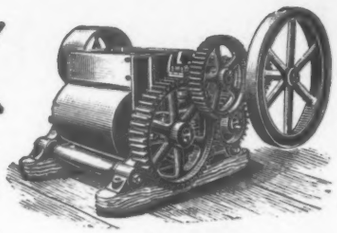

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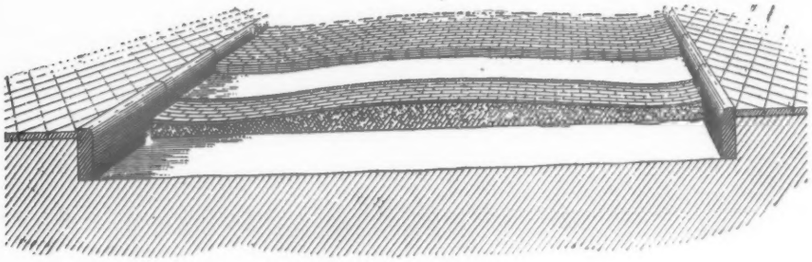

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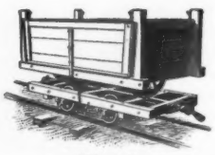

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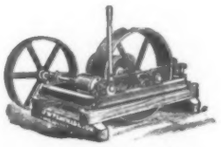

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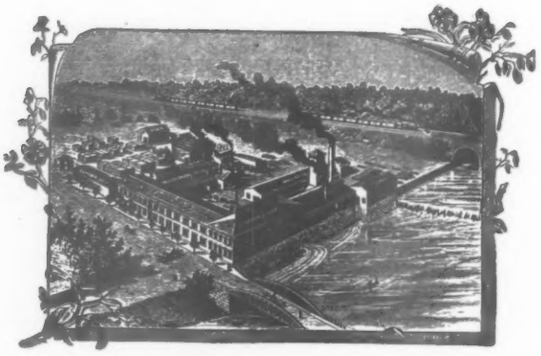

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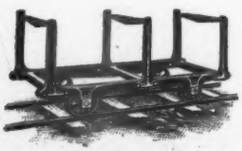

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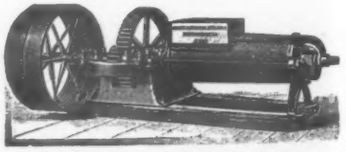

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VOL. 1. INDIANAPOLIS, IND., JANUARY, 1891. No. 8.


## CONTENTS.


| | PAGE. |
|---|---|
| The Manufacture of Paving Brick.....*W. A. Eudaly.* | 137 |
| Brick Pavements in Burlington, Iowa.....*William Steyh, City Engineer.* | 138 |
| Street Paving in Glasgow.....*Louis H. Gibson.* | 140 |
| Road Making as an Art.....*W. L. S. Bayley, C. E.* | 141 |
| Wood-Block Pavements in the South | 141 |
| The Trinidad Pitch Lakes | 142 |
| National Brick Makers' Association Meeting | 142 |
| The Asphalt Industry in California | 142 |
| Rock Asphalt in Columbus, Ohio | 143 |
| A Valuable Trade Publication | 143 |
| Personal | 143 |
| EDITORIAL | 144 |
| IMPROVEMENT AND CONTRACTING NEWS— | |
| Paving | 145 |
| Sewers | 146 |
| Water-works | 146 |
| Bridges | 146 |
| Street Lighting | 147 |
| Street Railways | 147 |
| Public Parks | 147 |


## THE MANUFACTURE OF PAVING BRICK.

*By W. A. Eudaly.*

THE leading points to be considered by one about to engage in the manufacture of paving brick are: Market, inclination, capital, clay, plant and management. The necessity for a good market is too well understood to require comment. In the locating of a plant it is always well to see that the shipping facilities are good. The next in importance, perhaps, is the inclination to engage in the business. Unless one is prepared to invest his capital in the paving brick business with *enthusiasm*, believing that brick is the coming pavement, that it is a profitable business to the manufacturer, that it is the most economical pavement that towns or cities can use, and that it is the best pavement now in use from a sanitary standpoint, he had better not invest his money.

I have known quite a number of capitalists to invest in paving brick plants in a sort of half-hearted way, arguing with themselves and with their associates that, perhaps, after all, brick pavements are not a success, fearing that there was no real profit in the business; and, in fact, I have been present at a number of directors' meetings, at which most of the time was spent in arguing questions which should have been settled before their investments were made. Men should know and investigate and come to some decided conclusion before investing their money; once they have determined to engage in the business, after giving it a thorough investigation, there is less likelihood of failure. Investing one's money at random to make a secretaryship or position for "my boy" or "my friend" is not business, and will not make a successful paving brick plant; such is not the right kind of capital. Be in earnest,—determine to make good brick, and sell them for a fair profit, and be satisfied with nothing short of this, is one requisite to success. The capital required varies so much in different localities,—to say nothing of the different sized plants, kinds of clay to be manufactured, etc.,—that it is impossible to make an estimate without first having all the circumstances and conditions at hand.

To illustrate we will start with clay. There are a great variety of clays, which are suitable for making good street paving brick, yet the kind of machinery best adapted to handle these several varieties differs widely. One would never think of attempting to prepare what is known as shale clay with smooth roll crushers; such clays usually demand heavy dry pans, which, in turn, require more power and greater strength of machinery, shafting, etc. Again, the distance from the machine, and lay of the land in the bank, determines to some extent the best method of mining and transmitting the clay to the clay-house. Also, the kind of clay has much to do with the kind of brick machinery to be selected, to say nothing of the capacity of the dryer. The same dryer will dry a great many more brick made from one clay than it will from another, so that it will be readily understood, that the clay to be used plays no small part in the cost and kind of plant. Again, the kind of men who engage in the business has largely to do with the capital required. There are two general classes of men that engage in the paving brick business. The one is the man who has been, for a long time, manufacturing other kinds of brick. This class of manufacturers is slow to change methods; generally, their present plants are not well adapted to making paving brick, and to make the necessary changes would require a considerable outlay. So that we often find old brick makers making paving brick in the old way, and while, perhaps, they may produce some good brick, they are tempted to deliver many that are very inferior. This has been the cause of paving brick being condemned in many instances. One would not expect to make a very excellent grade of flour on an old-fashioned corn mill—neither must he expect to make good street paving brick unless he is prepared with at least some of the most modern improvements.

Another class of men, who are usually very progressive and are often large property-holders in their city or town, and feeling the need of street improvement, join their capital to one, as manager, less fortunate in the possession of this world's goods, but with an *over-supply of experience* in making brick in the old way, and so the procession moves on to the first station, which we will call "Change of Management."

This last-named class usually start out with large ideas. They see the profits in a plant of 50,000 brick per day, and at once propose a plant of 100,000 brick per day. So it is that a plant is often begun on a very large scale, with a far less prospective market, and what is equally fatal, the lack of a proportionate amount of capital. Such plants usually have a hard struggle. In the paving brick business, as in all others, be sure you have sufficient capital to erect and start your plant with all the advantages offered by the experience and improvements of the past or present.

If you have been wise enough to have learned that you have a sufficient market, that your shipping facilities are such as you desire, that you mean to begin the business to win, that you have the requisite capital, that your clay has qualities for making an excellent paving brick, and if you have determined wisely the proper capacity of your proposed plant, you are ready to select the machinery, kilns and other appliances, which, I assure you, is no small task. But suppose this has all been done, and done well, and that your machinery (which includes everything from the clay bank to

the kilns) is of the proper strength, kind and capacity to handle your clay in the desired quantities, and that you have chosen the system and method of burning which is the one best adapted to your plant; and that the different parts of your machinery, dryers and kilns are arranged one with reference to the others, to the clay bank and the point of shipping, so that the material can be handled with the least amount of labor or loss, you are then ready for the management.

The management is often the most expensive part of the plant. Large plants often have what is termed a "General Manager," whose business it is to have general supervision of everything and everybody. Besides the General Manager there is a yard superintendent. It is not necessary that I should undertake to describe the duties and the importance attached to the faithful performance of the various duties devolving upon them. It is sufficient to say that the success or failure of the plant largely depends upon the judgment and activity of these two men

It is impossible to make an estimate of the probable capital required and profits to be gained in the paving brick business. I suppose it is fair to give some sort of an idea, though, no doubt, it will be wide of the mark in many instances. I have found, in a number of places, where street paving brick were to be made from a shale clay, using dry pans, pug mills, stiff or soft clay machinery, with ample power and artificial dryers, with good down-draft kilns, and allowing a small amount of working capital, that it requires about one thousand dollars to each thousand brick capacity per day. As to details, probable profits, etc., I prefer answering each individual inquirer separately.

---

## BRICK PAVEMENTS IN BURLINGTON, IOWA.

*By William Steyh, City Engineer.*

THE writer's attention was first called to brick pavements by a paper of Dr. George Baird, of Wheeling, W. Va., read before the American Board of Public Health, at their annual meeting held in Toronto, Canada, October 6, 1886, and published in the *Sanitary News*, of Chicago, shortly after. The street improvement of Burlington at that time consisted altogether of MacAdam and Telford pavements, the material employed in their construction being native limestone, which soon ground into dust in dry weather, changing to mud when wet, being partly scraped up with hoe and shovel every Saturday and hauled to some convenient dumping ground. This method of street improvements, aside from being an abominable nuisance on account of dust and mud, proved to be very expensive, the streets needing constant repairs, and were never in a satisfactory condition. Being then, as now, employed as city engineer of Burlington, I saw the necessity of adopting some more economical, as well as satisfactory method of street improvements. I addressed Mr. Hoge, city engineer of Wheeling, W. Va., and Mr. Bell, city engineer of Bloomington, Ill., on the question of brick pavements in their respective cities, and both gentlemen furnished me with a great deal of valuable information. From this and the various annual reports of a number of city engineers, who kindly sent me copies, I was enabled to compare the merits of the different paving materials, as well as their objectionable features, and determine what material would be best suited for Burlington.

Before drawing any final conclusion, I considered the questions of healthfulness, comfort, durability and cost, which are the most essential points in a street paving material.

Without going into details of the various materials employed in street pavements, I will mention a few of the most popular ones, and endeavor to point out their merits and defects:

GRANITE BLOCKS.—*Merits:* Durable, clean, healthful.
*Defects:* Noisy, uncomfortable, slippery when worn.
Expensive first cost.

SHEET ASPHALTUM.—*Merits:* Comfortable, clean, noiseless, healthful.
*Defects:* Short-lived, expensive to repair, slippery on steep grades.
Expensive first cost.

BRICK.—*Merits:* Comfortable, durable, clean, healthful, easy to repair.
*Defects:* Moderately noisy.
Moderate first cost, when material can be secured at home, thereby saving freight charges.

WOOD BLOCK.—*Merits:* Comfortable, noiseless, clean (when new).
*Defects:* Short-lived, unhealthful.
Moderate first cost.

There are various other pavements in existence, but as none of them are free from serious defects, I will pass them by and confine myself to brick pavements exclusively, as this pavement has, I think, the least objectionable features of any pavement now in use.

The most necessary article for a good brick pavement is, of course, the brick for the top course. There are a good many brick pavements laid to-day which are not first-class, owing to the fact that inferior material is used in the manufacture of bricks, and that the bricks are not selected as carefully as they should be; for these reasons we hear now and then of pavements that are far from satisfactory.

Let it be remembered, that a good many clays are not suitable for the manufacture of good paving bricks, as for instance fire clay when in a pure state and even when mixed with other ingredients, unless those ingredients fuse readily and permeate through the clay, when in process of burning. Having obtained a suitable quality of clay it must be thoroughly pulverized, so that the whole becomes a homogeneous mass, that will burn uniformly and show an even fracture when broken. The essential qualities of a good paving brick are hardness, toughness and density. It should absorb little or no moisture, and stand a pressure of at least 6000 pounds to the square inch. If such a brick is obtained and the pavement laid according to the following specification, it will give entire satisfaction, as is demonstrated by the first pavement laid in this city, which, after three and a half years' use does not show any perceptible wear. Next to the wearing surface, in fact equal to it, is the foundation for a pavement. The best of paving material will come in disrepute if supported by a poor foundation. A concrete base of not less than six inches thick makes a very superior foundation, but with our present arrangements of the underground systems in every city of the United States, where hardly a day passes, without some one digging up the streets hunting for gas or water leaks, or making sewer, water, gas or steam heating connection, the question arises, is it expedient, to incur the extra expense, of putting in a concrete foundation, and having it honeycombed in less than a month? Answering for the city of Burlington, I say no. Just as long as we continue this method it will not be advisable to spend too much money on street foundations. What ought to be done, and what undoubtedly will be done in the future, is to build conduits on each side of the street, near the curb line, large enough to receive all the pipes for the various underground system, as well as all the telegraph, telephone and electric wires. When this is done a solid core for the street will be left, on which a substantial foundation for the pavement, can be placed and left undisturbed for an indefinite length of time.

The size of bricks or paving blocks is often discussed and some parties favor a block twice as large or larger than the regular size of the building brick.

I prefer the regular brick for the following reasons. If a paving block of large dimensions is required, there is a large percentage of waste, as it is impossible to burn all blocks alike and suitable for paving purposes. The rejected blocks can not be used for any purpose and the manufacturer is obliged to charge more for his marketable blocks, than he otherwise would, to make up for the loss incurred, as no man is foolish enough to carry on a business where money is sunk instead of made. To use a block of large size on grades exceeding four per cent. the pavement becomes too smooth and does not afford as good a foothold for horses as the regular sized brick. It is an established fact, that a block can not be burned as uniformly as a brick, which is one of the main reasons why the brick should have the preference.

In some cities board foundations are put down the same as under a wood block pavement. This method is not very desirable as no perishable material should be used in any first class street improvements whether in foundations or on top. Aside from rotting in the course of time, it is rather difficult to get to any of the underground systems in case of necessity. Either an entire section of paving, the full length of boards, has to be taken up, or, in case the boards are cut through, the foundation is ruined, and consequently does not answer the purpose for which it was intended.

The question is sometimes asked if it would not be advisable to immerse the bricks in tar, pitch, or some other suitable fluid, before putting them in the pavement, to stop up the pores and thereby prevent the absorption of water, to which I will reply, that any brick which will absorb an appreciable amount of any fluid is not fit to be put in a pavement, as a porous brick lacks those qualities essential to good paving brick, and the immersion in tar or pitch, while it may stop up the pores, does not add to its strength or wearing qualities.

The contour of the finished pavement is another item which should receive careful consideration, as a pavement too flat or too crowning does not look well, aside from the inconvenience of driving over pavements where one side of the vehicle is elevated considerably over the other, on account of too much crowning; or, on the other hand, the water not draining off readily from the center towards the gutters, by reason of being too flat. The following formula will give a suitable contour for street surface: On grades not exceeding 5 per cent. the rise shall equal 1-80, and on grades exceeding 5 per cent. 1-100 of the chord or width of pavement. Thus, a pavement 40 feet wide shall have a rise of 0.5 feet in the first, and 0.4 feet in the last instance.

Our first brick pavement was laid in August, 1887, at the intersection of Main and Jefferson streets, and gave such universal satisfaction that the city authorities, in harmony with the wishes of the majority of taxpaying citizens, ordered to be paved 12,000 sq. yds. in 1888, 40,000 sq. yds. in 1889, and 43,000 sq. yds. in 1890, that Burlington now has about 95,000 sq. yds. of brick pavements with the prospect of continuing the good work of freeing the city from dust and mud, as fast as means will allow.

Burlington claims the honor of being the first city in Iowa to adopt brick pavements, followed by Fort Madison, Davenport, Clinton, Council Bluffs, Sioux City, Des Moines, Ottumwa, Cedar Rapids, and Dubuque, all of which are greatly pleased with their pavements. In conclusion, I might say, that on account of our adopting brick as the standard paving material a new industry has sprung up in our city, giving employment to a great number of people, which, considered in a business way is certainly very gratifying, as every dollar paid out for street improvements is distributed again amongst our citizens. The Granite Brick Company of this city, which commenced to manufacture brick in 1889, is continuously enlarging its plant, as the demand for paving brick far exeeds the supply, since one city after another in this locality adopts brick as the standard paving material.

*Preparation of the Road-bed.*—The earth road-bed on which the pavement is to rest shall be excavated to the required depth and when graded and shaped to its proper form, it shall be thoroughly and repeatedly rolled with a horse road roller, and all depressions which shall then appear shall be filled with sand, gravel or macadam, as may be directed by city engineer, and at such places where connections have been lately made with steam, sewer, water or gas mains, the earth shall be thoroughly and compactly rammed, the inequalities filled with sand, gravel or macadam, as may be directed, and rolled until the whole shall be uniformly compact and firm.

*Foundations.*—On the road-bed thus formed and compacted, a bottom layer of gravel cinders or macadam is to be laid to a depth three inches over the entire road-bed. No stones to be used whose greatest dimensions exceed two and a half inches. The whole is then to be thoroughly wetted and rolled with a horse roller of sufficient weight to properly settle to place. When the use of the roller is impracticable this foundation must be thoroughly wetted and rammed until compacted to the satisfaction of the city engineer and internal improvement committee.

*Surface Layer.*—On the foundation course will be laid clean river sand. It will be two inches in depth, and the sand shall be uniform in quality. The sand shall be raked into an even layer and the roller passed over the same twice or three times. After this the gravel and sand shall be sufficiently wetted to moisten the mass without "licking up," the rolling shall then be continued with a constant light watering until the cross-section shall be exact according to specifications and the surface layer and ground foundation compacted and made solid to the entire satisfaction of city engineer and internal improvement committee.

*Brick.*—On the surface layer of sand shall be placed a course of brick upon their flat or 4-inch surface and lengthwise of the street, care being taken to break joints, the same as when laid in a wall and to be laid as true to line as practicable. The brick being thoroughly rolled or rammed to settle into position. All broken brick to be removed and replaced with whole ones, which must be securely pressed into place. Upon this course of brick shall be spread dry, clean river sand, sufficient to entirely fill every joint and cover the entire course to a depth of one inch. Upon said course of brick so covered shall be placed a course of brick edgewise, and crosswise of the street, placing them close together and breaking joints as before specified; also to be placed true to line. At street intersections the bricks shall be laid at an angle of 45 degrees with the street, the bottom course to be laid at right angles with the top course. All crossings to be laid 6 feet wide, with a rise of 1½ inches in the center, as shown in the plan. The brick composing the top course shall be regular in shape and size and of the very best and hardest selected brick. They shall not be less in size than 7½ inches long, 4 inches wide and 2 inches in thickness and not more than 8½ inches long, 4½ inches wide and 2½ inches in thickness. The brick to be gauged and piled according to size, dividing on two-sixteenth of an inch. The brick to be laid in courses across the street, using the same size through each course. A proper amount of sand being used to bring the top of bricks of less gauge, flush with pavement, and top course to be thoroughly rolled until settled to conform to the engineer's stakes and to the satisfaction of city engineer and internal improvement committee. All brick used in the work shall be of the best quality, such as will meet the approval of the city engineer and internal improvement committee. Sample of brick to be furnished must accompany each bid. Top course of brick to be thoroughly covered with sand, carefully broomed in.

*Direction and Inspection*—The pavement shall be set to a uniform surface and regular grade as given from time to time by the engineer. And the entire work during its construction and after completion, and all the material used in constructing same, shall at all times be subject to the direction and inspection of the city engineer and internal improvement committee, and done to their entire satisfaction. And no work shall be considered as accepted which may be defective in its construction, although the engineer may have failed to point out the defect during the construction and before the final acceptance of the work; and any work condemned by the engineer as defective, or improperly done, shall be taken up and rebuilt or the defects ortherwise remedied as may be directed by the engineer.

Five per cent. of the whole amount will be retained by the city for twelve months, after the completion and acceptance of the work, as surety that the contractor will make any repairs and replace any defective material which may become necessary during the period of twelve months. Said five per cent. to be retained out of the portion to be paid by the city, provided, so much is payable by the city, but otherwise out of the money arising from special assessments. At the expiration of the twelve months, if the contractor has made the necessary repairs and complied with the stipulations herein contained, the five per cent. shall be paid over to the contractor, but otherwise the city engineer

shall have the necessary repairs made and deduct the cost thereof from the amount retained.

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## STREET PAVING IN GLASGOW.

*By Louis H. Gibson.*

GLASGOW is probably the cleanest city in the world. This is true despite the facts that the climate is moist and the population largely made up of very poor people, compactly housed. The growth of the city has been rapid within recent years; new Glasgow is a model city.

Not only are the streets of the city clean, but the same vigilance and intelligence which affect them has to do with the alleys, the passageways, courts, and the halls and stairways of tenement structures. There are no out-buildings which are allowed to be the receptacles of rubbish. In a city so clean it will be interesting to know how the streets are made and maintained. While we speak of Glasgow as a modern city, it must be known that there are parts of it very old and which contribute experience to guide in the selection of a proper material for street work. It may also be known that there is an unusual amount of heavy teaming; that there is no communication through the city by freight cars, and that everything has to be handled in heavy drays or vans. Farthermore, the close population and the comparatively narrow confines of the city, bring an unusual amount of wear upon their streets, and altogether the travel both as to volume in the aggregate and the loads carried in detail, is very heavy. Granite is the material used almost universally in street paving. There are one or two streets which have recently been paved with blocks and a few adamant and concrete pavements, but the prejudice of all is favorable to the granite pavements. No one appears to have any very high regard for anything else.

While this is true of Glasgow, it is well to bear in mind that it is not true of many other cities of the United Kingdom. But in this connection our attention shall now be directed to Glasgow. This statement is here made in order that the opinion favorable to granite and against other material be not considered more prominently than as coming from this city.

It is to be observed, as we notice these granite block pavements, that they are exceedingly smooth; that is, there are no depressions, no irregularities. The crown is uniform, the gutters and curbings nicely fitted, and altogether there is clear evidence of good design and good workmanship. Observing this I felt quite certain that the readers of MUNICIPAL ENGINEERING would be interested in the details of this work. Upon securing proper introduction to the city engineer, I found him quite ready to advance all information for which I might ask. The information herewith set forth is drawn from printed matter in the form of specifications, schedules and reports furnished by the engineer. Three kinds of contracts are made: one where the contractor furnishes the paving stones, crossings, channel stones for gutters, wheelers and curbings to the city; another, where labor for preparing foundation and laying streets only is required; and a third where both labor and material are furnished by the contractor. It will be noticed in examining schedules that contracts are made in all of this work for periods of three, five or seven years.

The paving stones are from 3 to 3½ inches broad, 5 to 8 inches deep and 6 to 9 inches long. There are other pieces 3 to 4 inches square on the head and 6 inches deep. Then there are 4 inch cubes. The channel stones and curbings are 5x7 inches by 10 to 15 inches, and not less than 2 feet 6 inches in length, and from that to five feet. Generally speaking this is the size material used in all street work in Glasgow. The matter of foundation for streets is highly interesting to all of us and I can do nothing better than insert that part of the specification which applies to the forming of the foundation. It is well to bear in mind that the expression "sets" is what we would call blocks in most of our American cities.

*Excavation.*—After the present paving sets have been removed, the street to be excavated to the depth of 12½, 13½, 14½, or 15½ inches (to suit the different depths of the stones), below the intended finished level; the necessary transverse curve or rise from the sides to the center being given to the bed. Where the streets are to be paved with re-dressed stones, the street to be excavated to the depth of the sets in the same proportion as above stated. Where the streets are macadamized, the contractor to remove the macadamized material, and excavate the streets to the depths before stated. The macadamizing may be used for bottoming, so far as found suitable for that purpose, but it must be thoroughly screened in order to remove any sand or mud.

*Bottoming.*—After the ground has been carefully prepared to the required sections, a bed of the best Whinstone metal, 6 inches in depth, broken to pass through a two-inch ring, shall then be laid over the whole surface of the roadway, be thoroughly grouted with a mixture of the best British bitumen and pitch oil, and thoroughly beat with a rammer while being grouted, the finished surface to be perfectly smooth. The Whinstone metal must be thoroughly dry before being grouted with bitumen. In the event of the board deciding that a concrete bottoming be substituted in place of the foregoing, it shall be composed of one measure of the best Portland cement to one measure of clean sharp river sand, and three measures of Whinstone metal broken to pass through a two-inch ring, all properly mixed previous to being laid on the roadway. The surface of the compound, when placed in its position, must be perfectly smooth and to the entire satisfaction of the master of works. The contractor to state whose Portland cement is to be used.

Herewith I provide the specification for the finished streets The expressions are somewhat different from ours, but are readily understood by any one interested in a question of this kind:

*Causewaying.*—The whole prepared surface to be paved with square dressed sets, assorted according to size, both as to width and depth, before being laid, and set on a bed of sharp clean river sand, in no place less than 1½ inches in depth. The sets to be laid (close up, hard to hard on the sides and ends, and properly banded) in straight and regular courses across the street, between the channel stones, and to levels shown on the sections, proper molds, carefully set every shift, being used if required for guiding the workmen—the whole to be afterwards well grouted with Portland cement or bitumen, and beat down with a beater not less than—— pounds in weight, and re-grouted, as also blinded with gravel, ¼-inch in depth. If considered necessary by the master of works, the contractor is bound to put on blinding a second time. The master of works to give instructions as to size of sets to be used in every street.

*Grouting.*—Cement grouting to be composed of one measure of best Portland cement to two measures of clean sharp river sand, all properly mixed. For bitumen bottoming and grouting, the bitumen shall be manufactured from pure coal tar pitch from gas-works, and the oil shall be of 1.000 to 1.10 specific gravity. Sufficient oil shall be used to produce a plastic grout. The contractor shall also be careful to see that the grout is boiling hot when used. The contractor to intimate to the master of works the name of the parties from whom the bitumen is obtained. When the master of works considers it necessary that chips of the same class of material as the paving set should be used in the filling in of the joints, the chips must be first passed through a ½-inch riddle, then be thoroughly kiln-dried, then afterwards passed over a riddle of ¼ inch mesh to remove all sand and dust, and laid in the joints in two layers. Previous to the chips being put between the joints, bitumen shall be run in to the depth of one inch; the first layer of chips shall then be put in, and thoroughly grouted with the bitumen, the second layer of chips to fill the joints level with the surface, and to be thoroughly grouted, as directed. One ton of chips shall not do more than 240 square yards.

I asked the engineer something about the life of a granite pavement. "Of course," said he, "that is a very difficult question to answer. The conditions vary so greatly that a proper statement under one order of things would be entirely wrong under

another. However, it is not unfair to state that a granite pavement may last from fifteen to twenty years under our hard conditions. When blocks in a heavily traveled section become worn we take them out, re-dress them and use them elsewhere. Thus it is you will see that we have blocks of varying depths and can use old and new blocks together; the heaviest blocks where the travel appears to be the greatest in new streets."

The curb stones are unusually broad and not very deep. They rest on the concrete base. In many instances the gutters are formed with channel stones 10 inches broad and 2 feet 6 inches long and of a thickness to correspond with the blocks used in paving.

The material used for sidewalks varies greatly. Sometimes they are made of flag stones, at others of varying kinds of concrete, asphalt and other material.

The best part of all the work is its execution. It is well and carefully done. The supervision is rigid and the contractors are held strictly reponsible for all failures. Rigid exactions are made. It is altogether a business matter carried out in a business way.

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## ROAD-MAKING AS AN ART.

*By W. L. S. Bayley, C. E.*

*PAVET arduam viam.*

Does he, indeed? Let us see. The rapid strides which our cities and villages have made in two of the three most important civilizing forces of our time, has caused the third to be neglected. Nothing is truer than that churches, schools and roads form a triumvirate which moves the world. With schools and churches far in the van, the plainest of geometrical figures is not complete because the highways are not paved. It is of little concern to us, road makers, to ask the reason why this neglect, but it is our duty to do what we can to secure the financial and sanitary effects which only good roads can bring.

The civil engineer in charge of public works finds, everywhere, governmental and local conditions which do not allow him to distinguish himself save in the direction of economy and accuracy.

Residence streets, as he finds them, do not require more than thirty lineal feet of width for the driveway proper. In this connection we may say that boulevards may have a standard width of fifty feet; seldom more, rarely less.

With the general grades of the city or town we have, in this, little or no concern; perhaps from the fact that there is no art in arbitrariness. But with reasonable license the engineer will locate his road-bed twenty-four inches at least below the average base of the dwellings which skirt the way, thus forming an ampitheater of beautiful proportions; then from dwelling to dwelling we have first the lawn, then the five foot cement sidewalk, then the public lawn, then the curb, roadway, and the same repeated till the vis-a-vis is reached.

The crowns of the street will be very light; longitudinal drainage wanes will slowly but surely carry the storm waters to the inlet, so slowly as to produce filtering effects.

A preparatory foundation will be economically secured after you have removed all loams, clays, black earths and decomposing vegetable matter. This done, and shapeliness secured, by the skill of the grader, the steam-roller and a judicious amount of water will have prepared the sub-surface for the eight or ten inches of limestone macadam. In this connection it is proper to say that all parts of the stone are required for properly filling the voids, because the whole is equal to all its parts. With a generous manipulation, this foundation will be found ample for sustaining its superincumbent load.

The indispensable prerequisites for wearing surfaces are that they shall be—

*First.* Non-retentive, for the public health.
*Second.* Impermeable.
*Third.* Dustless, if the care-taker has done his work well.
*Fourth.* It must not slip in a season.
*Fifth.* Elastic, hence noiseless.
*Sixth.* Hard and tough.
*Seventh.* Economical and lasting.

For this work you have asphalt, wood blocks, paving brick, limestone, asphalt blocks and granite-quartzites. Leaving the discussion of the merits of all of the above except the last, we claim that, with the selenite bond, we have secured all of the above numbers, hence have found what all are looking for.

Don't imitate ancient roads, because they had no traffic; don't imitate modern roads unless local conditions are similar. Don't imitate boulevards, because from first to last they are beyond your means and quite unnecessary, when we remember that the limestone foundation is waterproofed by the wearing coat.

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## WOOD BLOCK PAVEMENTS IN THE SOUTH.

CAPTAIN A. C. DANNER, president of the Wood Paving Company, was asked yesterday what his two years of experience in laying round cypress blocks has taught him; also, what is the actual condition of the wooden pavements laid by him. These questions were suggested by the fact that so far as outward looks are concerned, the pavements seem as good now as when they were put down nearly two years ago.

"We live and learn," said the captain, in reply. "We had to learn the art of laying wooden pavements, and some things of value have been learned by me and by those employed in laying the pavements. This experience has been learned not only through experiments here but through those made in Jacksonville, in Memphis, in Chicago and elsewhere.

"Two years ago I put down a piece of round block pavement in front of my house on Government street. This was done as an experiment. I wanted to find out for myself something about the lasting quality of the pavement. The experiment was not a fair one to the wooden pavement, for I did not then have a good quality stuff. I had to take what cypress I could get, and the result was that the experimental piece of paving was composed of more than half sap wood. The blocks were laid on cypress planks, laid flat upon the ground. Not long ago I took up the blocks, to see what was the bottom condition of things. I found that the plank was as sound as when it was laid down; but the bottom of the blocks, whenever the blocks were of sap wood, was affected by dry rot. The heart of the blocks was all right, but the sap wood was disintegrating, and eventually the dry rot would work its way through and destroy the pavement.

"This set me thinking. Evidently sap wood would not do, as there must be some defect in the manner of laying them. I came to the conclusion that the layer of plank was at fault, or, in other words, that the pavement would last longer if no plank were used. I verified my opinion by making a study of the wooden pavements in Jacksonville, Fla., where the blocks were laid directly upon the sand.

"The philosophy of this is, that cypress, where kept in contact with the soil, remains damp and does not rot. If the blocks were placed directly upon the soil they would have no dry rot. I knew that from experience I had had in handling cypress in years past, but I had not thought of it in connection with the street paving. I found, by inquiry, that wherever there is a sandy soil, or wherever a foundation of sand is made, the wooden pavement escapes the dry rot.

"Another idea acquired by knowledge was that the planks serve as a collector of seepage water, which, if it remained unabsorbed, would perhaps cause ill-health in the neighborhood of the pavements. If there are no planks, however, the seepage escapes from the bottom of the blocks into the soil and is absorbed. A third idea was that by using blocks alone and doing away with the foundation plank, the roadway can be crowned more evenly, and the blocks will pack better and make a sounder and smoother surface. All this I learned by taking up and relaying the piece of pavement in front of my house."

"I suppose you tried the new method practically, after this," said the reporter.

"Yes; we tried it at the intersections of streets on St. Joseph street. I think you will find those parts of the pavement smoother than the other parts where there is a substratum of plank. We also tried the no-plank method on Conception street. This was done with the approval of the city engineer and of the street committee. There does not seem to be any doubt but that it is the best method where the soil is sandy, and where the soil is loamy a layer of sand serves the purpose desired.

"Another fact that speaks in favor of the disuse of plank foundation, is that pipes can be laid down under a no-plank pavement without tearing up large sections of such pavement, as is necessarily the case where planks are used. For example, when the water pipe connection with the Bienville Company's office on St. Joseph street was made, we had to tear up the pavement for a distance of about thirty feet. If there are no planks, it will be necessary to take up only those blocks which cover the ground where the two-foot trench is to be dug. Anyone acquainted with the life of street pavement will see that the new method is advantageous so far as the pavement is concerned.

"Does doing away with planks make the work of laying pavements cheaper?"

"No," replied Captain Danner. "It rather adds to the expense, for when plank are not used the soil has to be rammed to a hard surface, and the cost of this ramming is greater than would be the cost of the cheap plank that would be used in covering the same amount of ground."

"You have spoken of the condition of your experimental pavement. How is it with the Dauphin street pavement?"

"That pavement has been down about a year and a half. I had to take up a piece of it a few weeks ago and I could find no evidences of rot or of wear. So far as I could discover the blocks were as sound and as good as when they were laid."

"I suppose the wood is heart cypress?"

"Yes; it is practically all heart cypress and juniper, and to this I attribute its success as a paving material.

"I want to add," said the captain, "that wooden pavement is making rapid advance in all parts of the world. It got a back-set some years ago because improper methods of construction were used, but the cities have at length discovered how the pavements should be laid, and are laying such pavements now by the mile. Chicago's report for 1888 shows: Cedar blocks, 47.15; Macadam, 3.67; Granite, 3.04 miles.

"The same rate of progress has been noted in 1889, and is continuing this year. And I say without hesitation that what wooden pavements Mobile has compare favorably with wooden pavements in any other city in the country. I have traveled extensively about of recent years and have made close observations of pavements everywhere, and there are no such pavements as we have. We have the best—which is due to the excellence of the material we can command. All we need is more pavements. The wooden pavement will wear out in time and will decay if it does not wear out before; but, notwithstanding this, it is the best and the cheapest pavement known for the same length of service."—*Mobile (Ala.) Register.*

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## THE TRINIDAD PITCH LAKES.

UNITED STATES Consul Sawyer, of Trinidad, in a recent report to the state department, says: The Pitch Lake, at La Brea, is too well known to require a description other than that it has an area of about 90 acres and contains the best quality of pitch in the world. Humboldt believed this pitch to be inexhaustible, because of the pitch springs beneath, and as the excavated places, dug with the pick-axe, refill with pitch in a few days, proves that there is a subterranean flowage. Lord-Admiral Cochrane, Earl of Dundonald, one of England's greatest naval heroes, obtained a lease in perpetuity from the government in 1847. Cochrane was in command of the West India squadrons at that time, when he often met his old friend Lord Harris, then governor of Trinidad. Through the friendship of Lord Harris, and by virtue of Cochrane's important naval services, the grant of the Pitch Lake was obtained. The lease was given at ridiculously low terms to the admiral, as the pitch was of no value at that time, the requirement being that a small quantity of pitch be dug and shipped to England for scientific purposes annually. But as Lord Cochrane carelessly failed to comply with the terms he lost the lease by its reversion to the Crown. Considering the great value of this property at this day, had the admiral fulfilled his part of the contract his heirs would now (no doubt) be the most wealthy family of the Scottish nobility. The lake is now leased to Messrs. A. S. Barber & Co. for a term of twenty-one years, from 1888, for £10,000 ($48,000) a year, payable to the Trinidad government. There is much dissatisfaction because of the cheapness of the terms and for other generous privileges given to the lessees."

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## NATIONAL BRICK MANUFACTURERS' MEETING.

THE fifth annual meeting of the National Brick Manufacturers' Association, will be held in Indianapolis, beginning on the 20th inst., and continuing until the 23d. The programme embraces papers and discussions on the following subjects, after the address of the president, T. B. McAvoy, of Philadelphia; "Brick Yard Vernacular," S. K. Fletcher, of Indianapolis; "The Elements of Paving Press Brick Machines," Thad. Smith, of St. Louis; "Brick Making in Alabama," J. W. Sibley, of Coaldale, Ala.; "What, How, and Why?" W. P. Gates, of Chicago; "Labor Troubles, How to Avoid Them," D. G. Harriman, of New York; "Drying Brick," Frank B. McAvoy, of Philadelphia; "The Pallet System; Its Advantages and Disadvantages," Frank Stiles, of North Haven, Conn.; "The Paving Brick Interests," R. C. Burtin, of Zanesville, Ohio; "Press Brick; their Manufacture and Use," William Roberts, Trenton, N. J.; "The Guthrie Kiln," Ellis Lovejoy, of Union Furnace, Ohio; "Drain Tile; its Manufacture and Use," E. M. Pike, of Chenoa, Ill.; 'Continuous Kilns," W. H. Puffet, Beatrice, Neb.; "Manufactured Gas for Burning Brick," William Washington, of Philadelphia, Pa.; "Vitrified Brick," general discussion. It is expected that the meeting will be very largely attended.

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## THE ASPHALT INDUSTRY IN CALIFORNIA.

SIXTY thousand tons of asphalt were imported into the United States in the year ending November, and forty thousand tons in the year previous. Ninety per cent. or over is used for paving purposes, this chiefly from Trinidad, the balance in the arts for paints, varnish, roofing, electric wires, etc. Five to six thousand car loads of a commodity likely to increase from fifty to a hundred per cent. per year, has called great attention to the presence of asphalt in the United States, and the possibility of supplanting foreign importation by our own supply. California is sure to be an important factor in this connection, and may in future be looked to to furnish many thousands of tons, not only for the Pacific coast, but wherever in the United States the railroads are willing to make rates to meet the foreign article. Los Angeles, Ventura and Santa Barbara counties have for years supplied limited quantities of asphalt, but Kern county is likely to be the theater of operations on a grand scale in the mining and production of commercial asphalt for paving and the other uses indicated. By asphalt, as the term is here used, is not included in any sense the so-called bituminous rock of San Luis Obispo and Santa Cruz counties, but the product which, after slightly refining, leaves a tough, tenaceous, pliable and slightly-elastic black hydro-carbon containing from sixty to eighty per cent. pure asphalt, and whose properties, as above, are found only in the natural article. About thirty miles south and west of Bakersfield are two fields, each about three to five miles long, and twenty miles apart. These deposits have been but slightly known or alluded to heretofore, but experts declare them to be probably second only in extent to the Island of Trinidad. They are located

on the foothills on the north side of the Tehachapi Mountains, and the east side of the Coast Range, respectively, and can be seen for miles when approaching them.

The source of the asphalt is seen in the still alive springs or "chimneys," which deposits layer on layer till it forms the low, wide-spreading cones or mounds, or spreads into gulches and over the hillsides, forming in places the more or less vast visible deposits and layers. Examination of the deposits and practical experiments by experts of long experience having demonstrated the great purity and excellence of the asphalt for paving and other purposes, the Standard Asphalt Company has been organized with a capital of $100,000, whose stockholders, including Messrs. Sol. Jewett, and H. A. Blodget, bankers of Bakersfield, and capitalists and men of experience in the use of asphalt of San Francisco and Kansas City; Messrs. S. Hutton and L. Blankenhorn, of the Asphalt Paving Company of this city, are identified also with the enterprise. A number of carloads of the asphalt have already been shipped for paving purposes to various cities, and arrangements are made for the production and shipment from Bakersfield of thirty tons per day, to be increased indefinitely with the demand. The company has also become the possessor of a discovery—now patented—by which asphalt is rendered pliable as rubber, and improving its properties and quality for use in roofing cloth and floor covering, electrical conduits, wires, and a thousand uses from which the occasional brittleness of asphalt has debarred it heretofore, on this account, as well as changes of temperature. Mr. Henry F. Williams, of San Francisco, for many years engaged in paving, the discoverer of the process referred to, is also interested in the Standard Asphalt Company. California, with its deposits of asphalt, should have the best paved streets and more of them than any other state in the Union, and add millions of dollars to its wealth when these deposits find the market it is now the intention of developing companies to make for them.—*Louis Blankenhorn in Los Angeles Times.*

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## ROCK ASPHALT IN COLUMBUS, O.

IN Columbus, Ohio, the Buckeye Paving Company of that city has just completed the laying of three streets with rock asphalt, on Woodruff and Ninth avenues and on State street in front of the Custom House building. The material with which these streets have been laid is the Kentucky bituminous sand-rock, held together by a silicious cement and thoroughly infiltrated with natural bitumen. The stone shows upon analysis 90 per cent. quartz sand, and 10 per cent. of bitumen. The manner of applying it is simply to crush and disintegrate the stone, after which it is heated in revolving pans and then conveyed to the street where it is spread and rolled on a concrete foundation, in the same manner that the artificially mixed asphalt pavements are laid. Natural rock asphalt has been used in the streets of London, Paris, Berlin and other cities on the continent for many years; in California, where it is also found, it has been laid in the leading cities of the Pacific coast; but this Kentucky deposit, which is said to be very extensive and the only other known in this country, has but lately entered the field.

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## A VALUABLE TRADE PUBLICATION.

WE have received from J. W. Penfield & Son, of Willoughby, O, a newly issued catalogue of brick making machinery which is a notably handsome publication. It comprises 160 pages and is a fine specimen of artistic typography and printing. It is profusely illustrated, and contains all information that is likely to be desired by one contemplating the purchase of machinery for the manufacture of paving or building brick.

## PERSONAL.

Mr. Pratt, superintendent of water-works at Seattle, Wash., has resigned.

A. J. Reynolds is the new superintendent of the Quincy and Boston electric railways.

Mr. Colby, engineer of the Public Improvement Commission, of Troy, N. Y., has resigned.

Mr. B. Shreiner, assistant city engineer of Des Moines, Iowa, was fatally shot on December 25th.

Mr. Robert Breaden, city engineer of Youngstown, Ohio, accidentally shot himself, December 10th, while out hunting. His injuries were fatal.

Mr. B. J. Smith, president of the well known incorporation of sewer pipe manufacturers, McMahon, Porter & Co., of New Cumberland, W. Va., died on December 4th.

Chas. W. Saacke has been appointed sole agent for Messrs. H. and A. B. Aveline & Co.'s silicum asphalt mastic. He continues his agency for the German asphalt works of Limmer and Vorwohle.

Mr. John C. Chase, C. E., for many years past, and continuing, City Engineer and Superintendent of the Clarendon water-works Wilmington, N. C., and Mr. J. H. McRee, C. E., late of the Cape Fear & Yadkin Valley R. R., have entered into partnership as civil engineers with office in Wilmington, N. C.

At the annual election of the Association of Civil Engineers of Dallas, Texas, W. J. Sherman, was elected president; D. A. Poynor, vice-president; E. K. Smooth, secretary: J. D. Trammell, treasurer; J. S. Thatcher, director, and W. L. Eustis, librarian. The regular meetings for 1891 will be held on the first Friday of each month.

Prof. O. H. Landreth, Dr. J. P. Drake and Mr. J. W. Gaines were appointed on Dec. 20, by the Commerical Club of Nashville, a committee to investigate the public road question. The committee is to report to the club what action, if any, should be taken to secure the passage of a general road law for the State by the next Legislature.

Col. Wm. H. Paine, who was formerly president of the American Society of Civil Engineers, died at Cleveland, O., December 31. Forty-two years ago he made surveys for a wagon-road to cross the Rocky Mountains. Since that time he has been prominent as an engineer, devoting himself especially to railways, bridges, and within the last two years, to cable street railways.

A. H. Bell, city engineer of Bloomington, Ill., has been at Danville since last June, acting in the capacity of "special engineer" upon sewerage and brick pavements. In that time Danville has laid about two miles of brick sewer—oval, 30x36 inches, and nearly three miles of pipe, 10, 12 and 18 inches. The paving contracts have included about two miles of brick street pavements and a large amount of brick sidewalks. The residents seem highly pleased with brick as a paving material, both for sidewalks and streets.

The Chicago Board of Drainage Trustees have displaced from his position Chief Engineer L. E. Cooley. The place was offered to Mr. Cooley's first assistant, who, as did all the other assistants in their turn, declined to accept the offer, and formally presented his resignation. W. E. Worthen, formerly president of the American Society of Civil Engineers, one of the most experienced hydraulic engineers in the country, has been appointed instead of Mr. Cooley. The fact that from $30,000,000 to $50,000,000 will be expended by the Chicago Drainage Commission, shows to some extent the responsibility of the person occupying the office of chief engineer.

PAVING AND MUNICIPAL ENGINEERING.

A Journal Devoted Specially to Street and Sidewalk Paving, Sewerage, Water-Works Construction, Street Lighting, and all Matters Pertaining to Municipal Engineering.

Published on the 15th of Each Month.

WILLIAM FORTUNE, Editor. - - - WILLIAM C. BOBBS, Business Manager.

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Advertisements to insure publication should reach the publication office not later than the 5th of the month.

Communications are invited, and all requests for special information on the subjects treated by this journal will receive careful attention.

Articles relating to the different branches of municipal engineering are desired. Stamps should accompany manuscripts for return postage if unavailable.

*The columns of this publication are open to the discussion of all subjects relating to paving, sewerage, water-works, street-lighting, and the physical improvement of cities. Practical information as to the merits of materials used in such work and new methods, with photographs and drawings, which may be used for illustration, are especially desired. We are glad to get brief notes as to proposed improvements and the letting of large contracts.*

*City engineers are requested to send us as early as possible copies of their annual reports, which will be given proper notice.*

*Articles relating to methods of road making and maintenance are invited.*

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IT is not generally known that the essential difference between the health of one street and another is shown to be the care or neglect in the removal of the poisonous germs of city dust ground to powder and driven everywhere, even into the air cells of our city lungs.

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THE programme which has been arranged for the annual meeting of the National Brick-Makers' Association, to be held this month, indicates that some consideration will be given to paving brick interests. It may be suggested with benefit to those who are engaged in the brick-making business that the subject can not receive more attention than it deserves. The rapid development of the industry, the remarkable growth of the demand for the product, the inadequacy of the present supply of good paving brick, and the large profits of the business, constitute sufficient cause to make the matter worthy very careful consideration by those who may, greatly to their advantage, add a new branch of brick-making to their business where they have material of the requisite qualities available.

THE committee in charge of the Indianapolis Paving Exposition is considering a proposition to make a public test of paving materials at an early day. The idea was suggested by H. D. Phillips, of Bellefontaine, O., and is regarded with favor, but before undertaking the project the committee decided to call upon practical men, who have given the subject most careful thought, for suggestions as to the best methods of making tests. This is a wise step. There is no test that can be fairly applied alike to the different kinds of material or systems of paving. Besides, the ordinary tests, as heretofore tried, are not the best proof of the valuable qualities of pavements. They may measurably indicate the comparative durability of materials, but there are other qualities in pavements little less desirable and important than durability, and when tests are made for the purpose of proving to the public that certain materials or systems are the best, they should be broad enough in scope to embrace all of the essential qualities of pavements. The assurance is given that the tests conducted under the direction of the Paving Exposition management will, if possible, be made of this character. The project will, no doubt, excite widespread interest. It calls for much ingenuity in devising a scheme of thorough tests, and, with the hope that some assistance may be given the committee in its commendable undertaking, we invite from our readers suggestions as to the various tests that should be made.

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IN pursuance of the purpose of PAVING AND MUNICIPAL ENGINEERING to place before the public—especially for the information of those who are seeking knowledge on the generally important subjects which we have undertaken to give attention—arrangements have been made to secure a very valuable series of articles on municipal improvement work and road-making during the current year. The variety of subjects which will be treated will be such as seem to be of most importance to those who are endeavoring to ascertain what is best and most essential in public improvements, but will, at the same time, be of interest to those who have acquired technical knowledge. There is no question more often asked those of whom information is sought than what has been the experience with different kinds of material, and different systems of work. Theories are not sought. It is the knowledge of practical experience that is wanted. It is this that we shall especially endeavor to place before our readers. In carrying out this purpose we have made arrangements with Mr. Louis H. Gibson, a practical writer, widely known in the United States, to visit the leading cities of Europe and describe their systems of public improvement, inquire into their methods and give the results of their experience. These articles may be expected to be very interesting and instructive. The first of the series, on the city of Glasgow, which Mr. Gibson visited in December, is given in this number. Others will follow from time to time. We have also arranged with other writers of high standing to contribute articles frequently on other subjects relating to the interests to which this publication devotes attention.

# Improvement and Contracting News.

## *PAVING.*

Sundry streets at Racine, Wis., will be paved.

Cedar Rapids, Ia., will use brick for paving next season.

Sundry streets, of Valparaiso, Ind., will be paved at a cost of $10,000.

T Street from Lincoln to Second, Washington, D. C., will be extended.

West Berry street, Ft. Wayne, Ind., will probably be paved with asphalt early in the spring.

A tar-concrete pavement is to be laid on the sidewalks of Melrose street, Providence, R. I.

Jefferson street, between First and Fifth, Dayton, Ohio, will be widened from fifty to sixty feet and paved.

Nashville, Tenn., will apply to the Legislature for power to issue $200,000 in bonds for street work.

Some of the streets of Wilmington, N.C., are being macadamized with limestone. The work is being done by convict labor.

It has been decided to enlarge the city limits of Dallas, Tex., to 36 square miles, and to make an additional bond issue of $1,500,000.

The St. Louis, Mo., board of public improvements has been considering a long list of streets to be graded. Brick paving is being brought to the notice of the street commissioner.

The city engineer of Houston, Texas, has prepared specifications for street paving, sidewalks, etc., which will be adopted in all future work.

The Findlay, O., Council has resolved to pave and improve Allen street, from the east line of Main street to the track of the T. C. & C. Railway Company.

St. Joseph, Mo., has ordered the St. Joseph Gas and Fuel Co. to put the streets in condition after they have been torn up for laying the company's mains.

Chestnut street, Chattanooga, Tenn., will be paved at once, and the Board of Public Works has also decided to pave Seventh street, from Broad to Chestnut.

Exhibits of paving brick have been sent to the Indianapolis Paving Exposition during the last winter by Grape Creek and Streator Companies of Illinois.

Knoxville, Tenn., will apply to the legislature for the power to issue $500,000 in bonds for street paving, bridges, sewers and other public improvements.

The cedar block paving which was put down 2 years ago in Peoria, Ill., is said to be in a bad state of decay, while the brick paving is still in excellent condition.

Under the auspices of the Citizens' Association, of Chicago, Ill., an attempt is being made to have Jackson street repaved from Halstead street to the river.

An ordinance has been passed at Cicero, Ill., granting the improvement of Lake street, from the city limits to Oak Park avenue with cedar block pavement; the grading, curbing and macadamizing of Clyde avenue from Ogden to 22d, and for improving Austin avenue from 22d to Ogden by grading, curbing, etc.

Ontario, Superior, Fourteenth, St. Clair, Illinois and Lafayette Streets, Collingwood, Canton and Woodruff avenues and Finlay Place, Toledo, Ohio, will be paved.

The contract for cedar block paving for Minneapolis, Minn., has been let to the West Michigan Paving Company, of Muskegon, Mich., at prices ranging from 80 to 86 cents per yard.

Cambridge, Mass., has awarded the contract for 300,000 granite paving blocks, 3½ to 4 inches wide and 7 to 8 inches long, 7½ to 8 inches deep, to Wilson & Riley, of Quincy and Cambridge, at $39 per 1,000.

Several resolutions have passed the Columbus, O., council for street improvement, including paving with asphalt, stone blocks, Hayden blocks, Hallwood blocks or brick, and 5 in. Berea or Fulton stone curbing.

Mr. Van Alst, engineer of the improvement committee, Long Island City, N. Y., has submitted estimates as follows for macadamizing: Jackson ave., $218,694; Vernon ave., $330,230; the Boulevard, $69,810.

The contract for paving Second street, Ashland, Wis., from Ellis avenue to Seventh avenue west has been let to W. E. Davis, his offer being for cedar block paving and granite curbing $1.45 per square yard.

The prices of bids received by the Oakland, Cal., council for cement walks on Jefferson Square and around the City Hall, ranged from 13 to 15 cents per square foot, and from 30 to 50 cents per lineal foot for curbing.

Contracts for brick paving in Key West, Fla., have been awarded to Miller & Nims, of Nebraska City, Neb., and Wm. G. Bear, of Kansas City, Mo.; the latter has sublet his contract to Walker and Hendricks, of Tampa, Fla.

The Peoria, Ill., street committee has prepared estimates for street improvements at the following prices: Excavation, 30 cents per cubic yard; setting curb, 5 cents per lineal foot; brick pavement, $1.55 to $1.65 per square yard.

The Minnehaha Quarry Company, of South Dakota, has secured contract from the West Chicago Street Railway Company for $70,000 worth of paving blocks, which will require 600 cars to convey the stone from Minnehaha, S. D., to Chicago.

The property owners of Jackson Boulevard, Chicago, wish to widen that thoroughfare and pave it. They incline towards asphalt. It is the purpose of the park commissioners to make that boulevard one of the finest streets in the country.

The bad condition of a road in Allegheny county, Pa., recently caused the overturning of a wagon, by which the driver was killed. The coroner thought that the Legislature should take some action in regard to the repair and maintenance of public roads.

Mr. Force, city engineer of Cleveland, O., has prepared estimates for paving Dodge street with different materials at the following prices: Stone, block, 35 cents per square foot; brick, 20 cents; brick on concrete or brick foundation, 28 cents; Trinidad asphalt, 38⅓ cents.

Hon H. Hice, T. L. Kennedy, W. J. Stewart, R. R. Hice, G. F. Kennedy and Agnew Hice have organized a new company for the manufacture of paving and fire brick. Their works will be located in Brady's Run Valley which is celebrated for its rare mineral deposits and will adjoin the "Brady's Run Fire Clay Company's" works.

Mr. William S. Bocot, engineer of roads in Richmond county, New York, has prepared new specifications for Telford and McAdam pavements which in many particulars have exceptional merit. The roads of Richmond county are to be extensively improved.

The appropriation bill for the District of Columbia includes the following items for street work: Repairs to streets and alleys, $55,000; repair of county roads, $60,000; granite block paving on Brightwood ave., $15,000; asphalt paving on Fourteenth street, $15,000; street work in Georgetown, $33,000; sprinkling, sweeping, and cleaning streets, $115,000.

Street improvement is needed at Dunkirk, N. Y., but no definite action has been taken. Some favor the plan of each person paying for the work in front of his own premises, whether macadam, brick or stone pavement; while others endorse the present plan of levying a continual 6-mill tax to help every street pay one-third of the cost of its improvement.

At a meeting of the Ways and Means Committee, of Toledo, Ohio, bids were received for an issue of $47,500 in bonds, bearing interest at the rate of 4½ per cent. and running to May 15th, 1907. The bonds are for the payment of the cost and expense of constructing street intersections on the line of the various improvements made during the year.

The Washington, Pa., council has awarded contracts for vitrified paving brick as follows: A. O. Jones & Co., Zanesville, O., 1,000,000 at $13.20 per 1,000; American Fire Clay Company, Toronto, O., 1,000,000 at $13 25; Smith, Porter & Co., West Cumberland, W. Va., 1,000,000 at $13.25; Pittsburg Clay Manufacturing Company, New Brighton, Pa., 1,000,000 at $13.50.

Governor Hill in his annual message renews his previous recommendations with reference to the improvement of country roads in New York State. The plan suggested was to construct at the expense and under the supervision of the state, two highways in each county, intersecting at about the middle of the county, or at its principal place, and so connected as to form a network of well built roads through the state. The bill embodying the Governor's plans, which failed at the last session, will again be introduced.

At Key West, Fla., contracts have been let at the following prices: Brick paving, $2.69 per square yard; bluestone curbing, 4 inches thick, 4 feet long, 16 to 20 inches deep, 91 cents per lineal foot; brick gutter, $3.44 per square yard; brick sidewalks, $2 per square yard; grading, $1.50 per cubic yard in excavation; haul over 1,000 feet, 1½ cents per cubic yard. The paving brick to be 7 to 9 inches long, 2 to 2½ inches thick, 4 to 4½ inches wide; set on edge; and at street intersections set at an angle of 45° with the street.

Matthew Hays & Son, of Tampa, Fla., are at work on four different kinds of pavement,—cypress blocks, stone, shell and block asphalt, in Tampa and St. Augustine. They also have the contract to pave the rock road between Tampa and Yboe City.

The San Francisco, Cal., street department has awarded contracts as follows for furnishing materials during the ensuing year: D. Harney, basalt blocks at $35.35 per 1,000; crosswalks 68 cts. per lin. ft.; brick at $10 per 1,000. California Construction Co., Oregon pine and redwood lumber, $17.90 per 1,000. H. C. Manuel, gravel, 64 cts. per ton. Holmes Lime Co., Portland cement at $3.39 per bbl. for Gillingham's; $3 39 for Johnston's; $3.49 for Knight's.

City Engineer Shawver, in his annual report of the work done under the direction of his department, in Indianapolis, in 1890, gives the following summary: 11,667 feet of asphalt roadway, $169,536.60; 6,234 feet of macadamized roadway, $19,948.80; 32,394 feet of bowldered gutters, $16 001.91; 45.237 feet of stone curbing, $25,214.47; 50,724 feet of brick pavement, $20,441.97; 1,220 feet of cement pavement, $2,112.00; 23,223 feet of graveled streets, $49.425.56; 13,111 feet of graveled alleys, $5,771.00; 1,724 feet of bowldered alleys, $919.25; 15.579 feet of gutter stone, $3,455.00; 4,527 feet of double-walk stone, $2,928.13; 3,740 yards of bowldered wings of streets, $2,086.12; 24,095 feet of brick sewer, $75,325.00; 2,280 feet of pipe sewer, $3,154.00; 45 street gas lamps, $945.00; 1 fire cistern, $1,360.00; 2 bridges, $3,695.00; Stone wall and rip-rap, $6,680.37; total, $408,976.18.

## *WATER-WORKS.*

$150,000 will be spent for water works at Lima, Ohio.

Aberdeen, Wash., has voted $65,000 for a better water supply.

An extensive plant has been contracted for at Madison, Ill.

Renova, Pa., will purchase about $5,000 worth of the ten inch water pipes.

It is proposed to lay new water pipes on twenty-five streets of Philadelphia.

The citizens of Amhertburg, Mich., propose to build a $27,000 water-works.

Dr. William P. Sevett is constructing a water-works system at Terryville, Conn.

The question of establishing a water works system is being agitated at Iowa Falls, Ia.

Over one hundred miles of water pipes will be placed in the ground in and near San Bernardino, Cal., this season.

The Newton, Mass., Council appropriates $29,000 for new water mains and $13,000 for water pipe and special castings.

A $15,000 filtering attachment to the Rock Island, Ill., city water works will be erected as a memorial to P. L. Cable.

A system of water works with a reservoir 300 feet above the level of the town will be constructed at Kendrick, Idaho.

The Blythebourne Water Company, of Brooklyn, N. Y., capital $10,000; a company at Boothbay Harbor, Me., the Brunswick Water Company, of Brunswick, Md.; the Newport Water Company, of Newport, Pa., capital $1,000; and a company at Elizabeth, Pa., have been incorporated.

Extensions will be made by the water works companies of Springfield, O., Staunton, Va., Hurley, Wis., Salem, Utah, Salem, Ore., Reynoldsville, Pa., and Waverly, Mass.

The city water works, of Sacremento, Cal., have examined the pumping plant and found it to be in bad order. A new pump, lifting 10,000,000 gallons daily, will be put in.

MacRitchie & Nichol are the engineers employed by Quincy Ill., to prepare a plan and estimates for a complete system of water-works, total cost of which is estimated at $620,000.

The Olympia Water Company, of Olympia, Wash., have secured the right to use Percival creek, on the west side, for water-works, and will immediately put in a system of water mains.

Water works will be established at Milledgeville, Ga., Cresco, Ia., Oakland, Nebr., Olney, Ill., Wall Lake, Ia., Belleville, Mo., Oklahoma City, O. T., Avoca, Ia., Rushville, Ind., Clinton, N. J., and Lamoine, Me.

The Salem Water-works Company, of South Salem, Ore., is making arrangements to extend its mains to Fairmount Park, south of that place. They will build a 2,000,000 gallon reservoir, and improvements will cost $50,000.

The water works question is agitated at Asheville, Ala., Orange City, Ia., Tarkio, Mo., Blue Springs, Nebr., Ilion, N. Y., Hill City, Tenn., Rushville, O., New Albany, Ind., Rockville, Conn., New Castle, Pa., Quincy, Mass., and Decatur, Nebr.

The Denver (Col.) Water Company is putting in a system of reservoirs, pumping plant and necessary houses, to cost, eventually, $6,000,000, one-third of which has already been expended. The reservoir will be 450 feet above the city and have a capacity of 60,000,000 gallons of water, to be emptied every eighteen hours.

The Owens Water Valley Company has been incorporated at San Francisco, Cal., for the purpose of acquiring water rights, and of conveying and conducting water in and through the Owens River and Indian Wells Valley for domestic and other uses. Capital, $2,000,000, of which $1,320,000 has been subscribed. Andrew J. Robinson, J. W. Wesson, G. P. Rixford and others are interested.

## *BRIDGES.*

Boston, Mass., is agitating for several new bridges.

Surveys are being made for a new bridge over Niagara Falls.

The steel bridge across the Columbia at Vancouver, Wash., will be 6,000 feet long.

The King Bridge Company have the contract for the $15,000 iron bridge across the Republican River at Superior, Neb.

The Youngstown Bridge Company will construct a handsome bridge, 860 feet long by 20 wide, at a cost of $10,000, at Ellwood, Pa.

The Wrightsville & Tennile railroad has been granted a franchise to erect a drawbridge across the Oconee river at Dublin, Ga., to cost $55,000,

A magnificent steel structure to connect Newport, Ky., with Cincinnati over the Ohio will be erected by the Central Railway and Bridge Company.

The Spokane Falls (Wash.) city council have awarded the Smith Bridge Company, of Toledo, O., the contract for the new Monroe street bridge for $107,000.

The East Omaha Land Company corporation has accepted plans for a new railroad and wagon bridge across the Missouri River at Omaha, Neb., to cost $1,500,000.

Mr. P. Moran, of Sault Ste Marie, Mich., has the contract for building the bridge across Whaiskai Bay into Bay Mills. The trestle is over a mile and a half in length.

The Upper Bridge Company of Pittsburgh, Pa., has been incorporated with a capital of $200,000 to construct a bridge over the Monongahela in the 23d Ward. William J. Burns and Chas. G. Milnor of Pittsburgh are interested.

Another bridge is proposed at New York, which is to be a six-track bridge across the Hudson, to be double the capacity of the present Brooklyn bridge; will be 6,500 feet long, and it is the intention of the company to complete it in five years.

A $1,000,000 bridge across the Columbia River at Vancouver, Wash., is being constructed, and will be 6,000 feet from the Washington to the Oregon shore; will be double-tracked, and the whole structure will be of steel. It will not be completed before Jan. 1, 1892.

## *SEWERS.*

At Holley, N. Y., a sewerage system will be established.

A sewerage system will be established at Revere, Mass.

Nashville, Tenn., will use $75,000 to construct new sewers.

It is proposed to spend $1,500 on sewers at Brocton, Mass.

Wilmington, N. C.—Plans for a sewerage system are being prepared.

Macon, Ga., will issue bonds for $210,000 for sewerage and drainage.

A sewerage system will be constructed at Jamestown, N. Y., at once.

$175,000 will be expended in sewer improvements in Knoxville, Tenn.

About eighteen miles of sewers will be built in Minneapolis, Minn., next season

P. J. Murphy has the contract to build a sewer in Conanicut avenue, Jamestown, R. I.

The Lynn, Mass., council has made an appropriation for $10,000 for a drainage system.

Albion, N. Y.—A sewerage system will probably be constructed here at a cost of $90,000.

Sixteen and one-quarter miles of sewers were constructed at Colorado Springs, Col., last year.

Dunn & Hastings have the contract to construct a sewer on Superior avenue, Allegheny, Pa.

Ordinances have been passed for the construction of several pipe sewers in Pittsburgh, Pa.

The 33d street sewer Pittsburgh, Pa., work on which was commenced two years ago, has been completed by Evan Jones, the contractor. It drains an area of 1,800 acres and has cost $250,000.

An ordinance authorizing expenditures of $75 000 for new sewers, has passed the Wilkesbarre, Pa., council.

At Syracuse, N. Y., committee on sewers will recommend the construction of a sewerage system in the Fifth Ward.

It is expected to extend the sewer system of Grand Forks, North Dakota, next season to the extent of about $50,000.

A bill to authorize the Spartanburg, S. C., council to issue bonds for a sewerage system has passed the State Legislature.

The Waltham, Mass., Board of Aldermen, at its last meeting, adopted an order appropriating $299,000 for a sewerage system.

The plans for the proposed east side trunk sewer in Rochester, N. Y., have been submitted to Mr. Samuel M. Gray for approval.

A considerable amount of sewerage work, with Wilson and Smith in charge, is to be carried out on the Waring system in Washington, Pa.

A committee has been appointed by the council to consider ways and means of establishing a complete sewerage system at Bridgeport, Conn.

Contracts have been awarded to Harry Smart, John Gellespie, John McCairn and W. B. M. Conklin for branch sewers in Philadelphia, Pa.

Sewers will be constructed on Jane street, Lowell, Mass.; Eighth street, Chester, Pa.; Oliver street, Birmingham, Conn., and numerous streets of Newark and Patterson, N. J.

The sewerage commissioners of Victoria, B. C., have awarded the contract for the construction of the sewerage system to McBean & Co., of San Francisco, Cal., at $245,970. Work will be commenced in March.

The appropriation bill for the District of Columbia includes for sewerage, $43,000 for cleaning and repairing, $25,000 for replacing obstructed sewers, $119,000 for main and pipe sewers, and $58,390 for suburban sewers.

The Massachusetts state board of health in considering the question of an independent system of sewerage for Woburn, investigated a scheme by which the sewage was to be collected on the easterly side of Horn Pond, and pumped through a force main about two miles long, to a level tract of gravelly land north of Montvale. The estimated cost of adopting this scheme would be about that of uniting with the proposed metropolitan system.

In Newark, N. J., during 1890, there were 3,506 feet of brick sewer built, 4.21 miles of pipe sewer, 90 basins, 159 manholes and 1 flush tank; the cost of this work was $79,804. There are now 51.40 miles of brick and 43 76 miles of pipe sewers, 1,789 basins and 20 flush tanks. The amount of sewage pumped was 2,542,747,144 gallons, an average of 7,028,219 gallons per day, with an average coal consumption of 2,328 pounds.

Sewers will be constructed in Second street, from Orange street to Sussex avenue; East Kinney street, from McWhorter street to Pacific street, Elm street from Sandford to Lang street; Burnett street, from James street to Central avenue; Bedford street and Springfield avenue to connect with Haysbrook; Thompson street and Seventh avenue, from Orange street to the north Thirteenth sewer; and in Fourth avenue from Sixth avenue to Morris & Essex Railroad, Newark, N. J.

## *STREET LIGHTING.*

The streets of South Haven, Mich., are to be lighted by electricity.

There is talk of a new electric light company in Corsicana, Texas.

Electric plants will soon be in operation at Eureka, Utah, and New Albany, Ind.

Electricity is needed at Brighton, Mich., De Kalb, Ill., Memphis, Tenn., and Montpelier, O.

The Flint Electric Light Company of Grand Rapids, Mich., will put in an entirely new plant.

The Florida Electric Company has been awarded the contract to light Tampa with electric lights.

The Western Electric Light Company of Chicago has been awarded the contract for constructing the electric light plant at Sheffield, Ala.

The electric light systems of Flint, Mich., Greenville, Mich., Allegheny, Pa., Rome, Ga., Manchester, Va., Riverton, Pa, have been giving great dissatisfaction.

Mr. Neiman has received franchise to light Brooklyn, Illinois, with electricity, and intends building a larger plant and providing more engines, which will defer the completion of the works.

The Chehalis, Washington, city council has granted to Francis Donahue, H. B. Koffman, and J. R. Weity a franchise extending over thirty years for an electric light system to be in operation at the end of three months.

The lowest estimate for building a 2,000 candle power electric light plant to run 400 lamps, at Wheeling, W. Va., was $61,000, but a plant to cost $80,000 will probably be put in, making the place the best lighted city in the United States.

Electric lights are agitated at Virden, Ill., Niagara Falls, N. Y., Ronceverte, W. Va., Lancaster, Pa., Lampassas, Tex., Cresco, Ia., Bethany, Mo., Cape May, N. J., Grand Rapids, Mich., Palatka, Fla., Versailles, Ky., Phillips, Me., Mystic, Conn., Bellevue, O., Hamilton, N. Y., Sellersville, Pa., Scottsville, N. Y., Covington, Ga., Palmyra, N. J., and at Franklin, La.

Electric plants will be put in at Dawson Ga., Plainfield, N. J., Newark, Del., Saugerties, N. Y., Sycamore, Ill. Salem, Ill., Cambridge, O, Kenosha, Wis., Springfield, Vt., Silverton, Ore., Hallettsville, Tex., Stroudsburg, Pa., Bement, Ill., Columbus, Wis., Dundee, Ill., Thornton, Ind., Addison, N. Y., New Sharon, Me., Titusville, Fla., Waterloo, Ia., Stevens Point, Wis., Hinton, W. Va., Wheeling, W. Va., Doyleston, Pa., Crawfordsville, Ind., and Thornton, Ind.

Extensions will be made by the Sommerville and Raritan electric light company, of Sommerville, N. Y., the Alton gas and electric light company, of Alton, Ill., the electric light company, of Detroit, Mich., the electric light, power and ice company, of Victoria, Tex., the electric light and power company, of Fort Worth, Tex., the electric light and power company, of Saugherties, N. Y., the United States electric light company, of Buffalo, N. Y., the Powelton electric light company, of Philadelphia, Pa., and to the plants at Easton, Pa., Oswego, N. Y., Salem, Va., Garrettsville, O., and Lockhaven, Pa.

The village electric gas light and railway company of Chicago, Ill., capital $50,000; a company at Manchester, N. H., the Warsaw electric light and power company, of Warsaw, N. Y., capital, $25,000; a company at Sharon, O.; the Plainfield gas and electric light company of Plainfield, N. J., capital, $175,000; the Honey Grove ice and electric company, of Honey Grove, Tex., capital, $25,000; the East Aurora electric light company, East Aurora, N. Y., capital, $12,000; the Stevenson-Hoggson electric light company, of St. Louis, Mo., capital, $100,000; the Chicago incandescent light and wiring company, of Chicago, Ill., capital, $10,000; Chehalis light and water company, of Chehalis, Wash., capital, $60,000; the Vermont electric company, Burlington, Vt., capital, $100,000; the Sharpsville electric company, of Sharpsville, Pa., capital, $15,000; companies at McKeesport, Pa., and Falls Church, Va.; the electric light company, of Montclair, Col., capital, $20,000; the Delaware lighting company, of Philadelphia, Pa., capital, $50,000; the Schuylkill lighting company of Philadelphia, Pa., capital, $50,000, have been incorporated.

## *STREET RAILWAYS.*

Electric street cars at Dubuque, Iowa, are to be heated by electricity.

On the street car lines of Cedar Rapids, Iowa, horse power will be replaced by electricity in the spring.

There is talk of extending the new electric street railway system between Minneapolis and St. Paul.

The franchise for connecting the street railway from Broadway on Tenth street, to Walnut avenue, has been granted by the East St. Louis, Ill., council.

The Southern Electric Street Car Company has organized at Roanoke, Va., with a capital of $500,000. The officers are: M. A. Riffe, prest., R. H. Woodrum, vice-prest., R. E. Cole, sect'y, J. W. Coon, treas.

The City Electric Street Railway, of Lincoln, Neb., is extending its line further east on N street, by laying track from 18th to 20th, thence running south to connect with the present line running to Fortieth and Randolph.

## *PUBLIC PARKS.*

The site of the Andersonville prison will be converted into an historic park.

By the purchase of 9,000 acres of land between City Creek and Emigration canons, the Salt Lake City, Utah, council secures some 15,000 acres, to be utilized for park purposes.

Mrs. Lydie Bradley, of Peoria, Ill., has made a proposition to the city council to donate one hundred and fifty acres to her previous donation of thirty-nine acres for park purposes, provided the city will control and maintain the same under three park commissioners, provisions to be complied with as soon as possible.

# BOOKS

FOR SALE BY

## Paving and Municipal Engineering

Chamber of Commerce,

INDIANAPOLIS, IND.

TREATISE ON

**LIMES, HYDRAULIC CEMENTS**

**AND MORTARS,**

BY GEN. Q. A. GILMORE. Papers on Practical Engineering, United States Engineer Department No. 9, containing reports of numerous experiments conducted in New York City during the years 1858 to 1861, inclusive, with numerous illustrations, 8vo., cloth, $4.00. Sent postpaid on receipt of price.

PRACTICAL TREATISE

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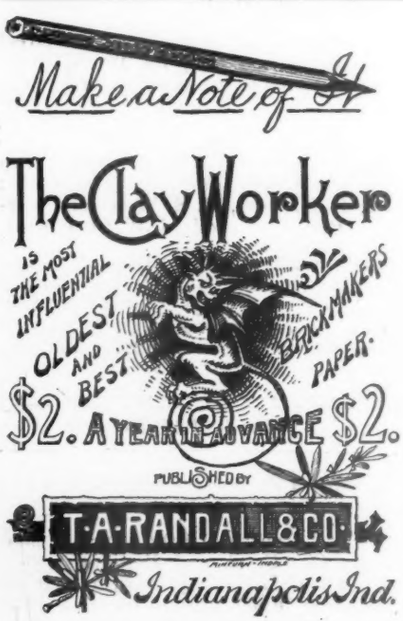


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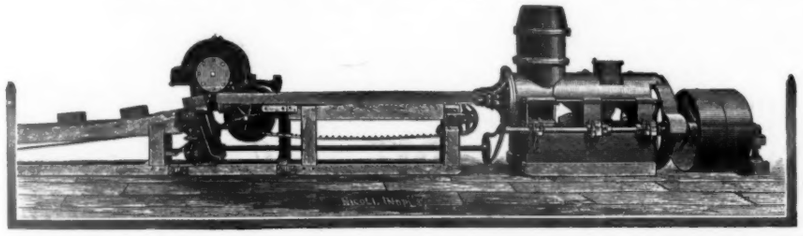

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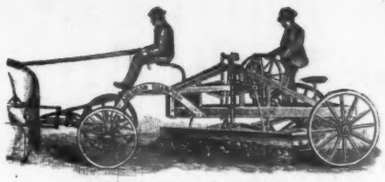

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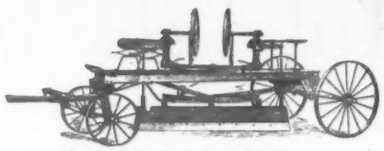

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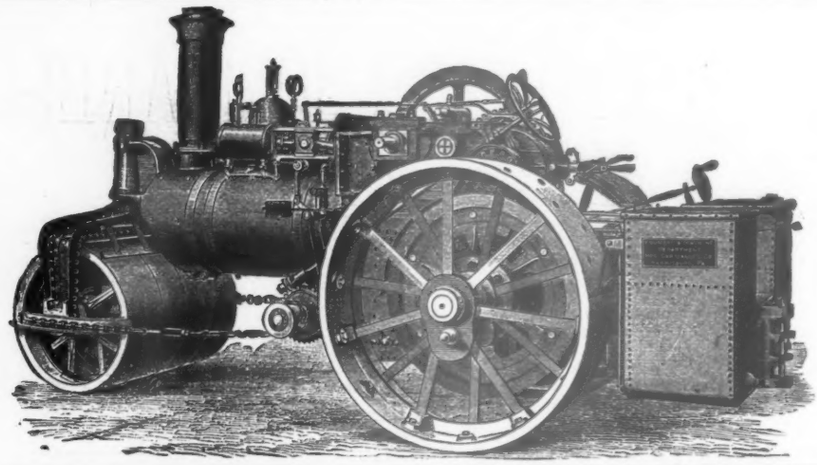

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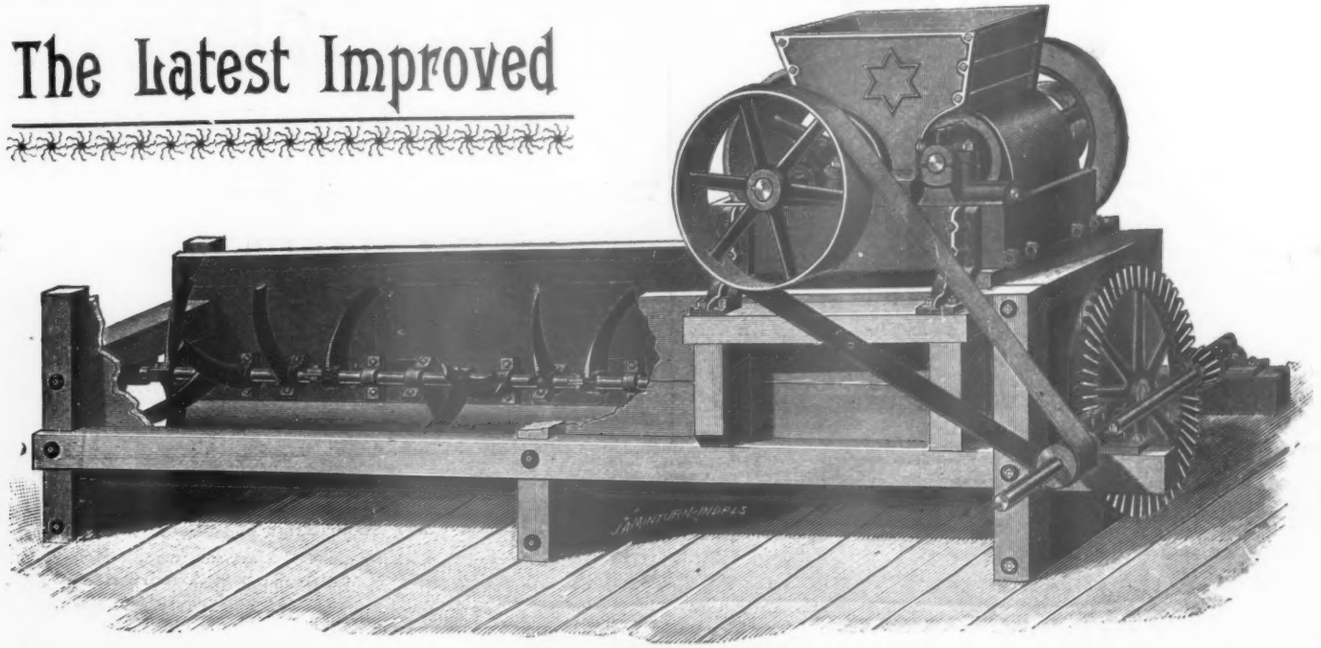

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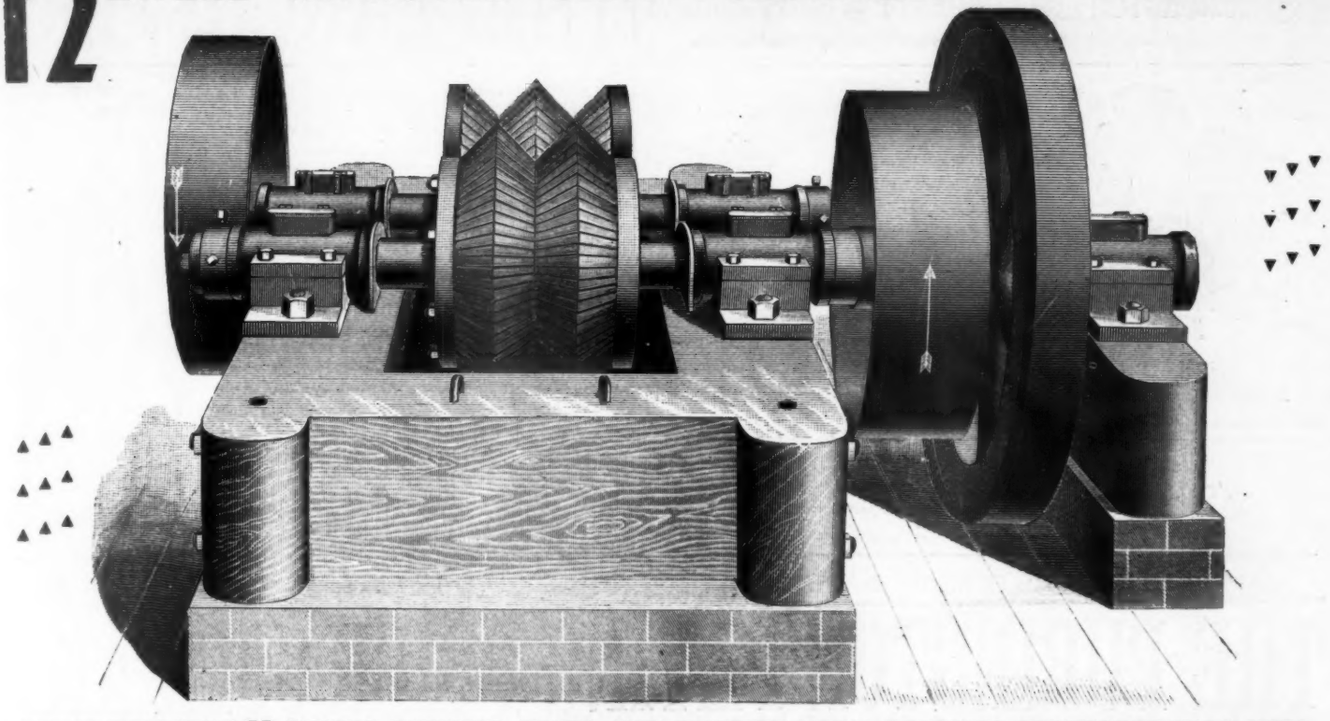

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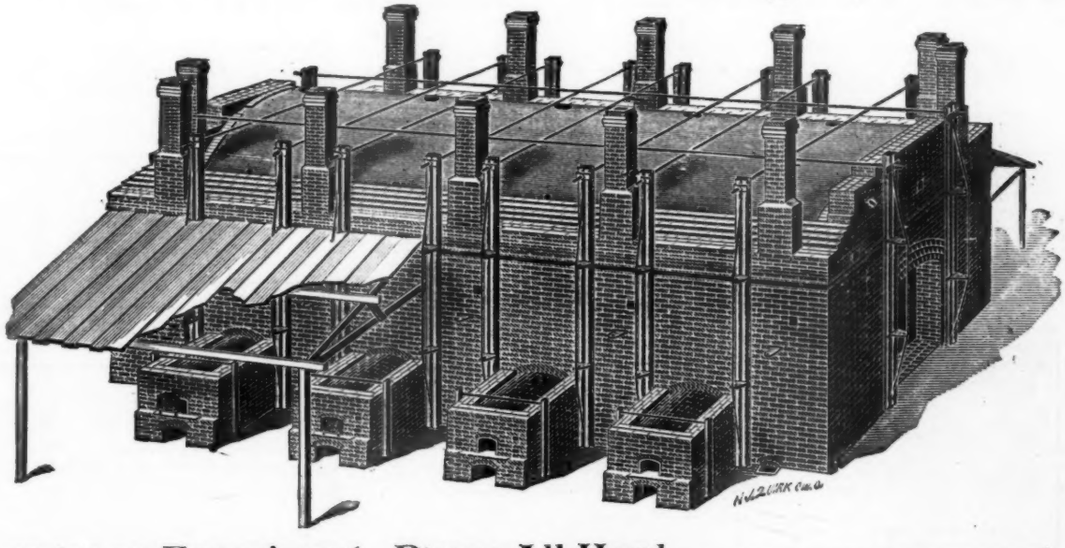

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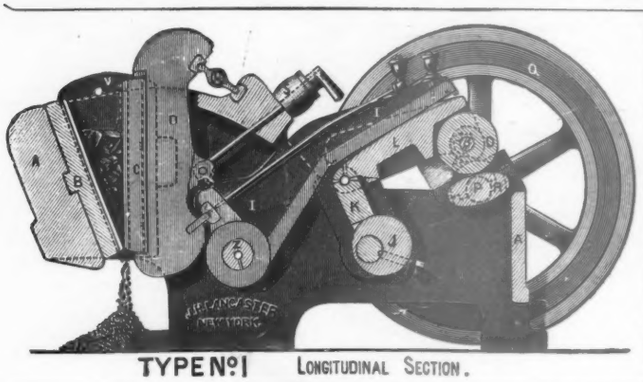

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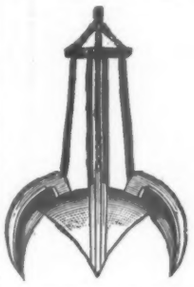

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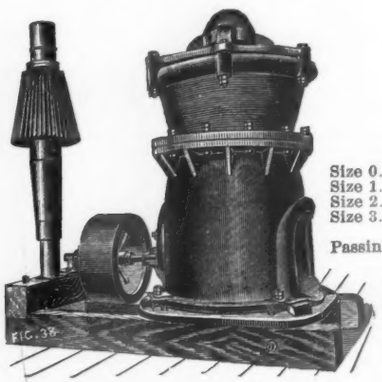

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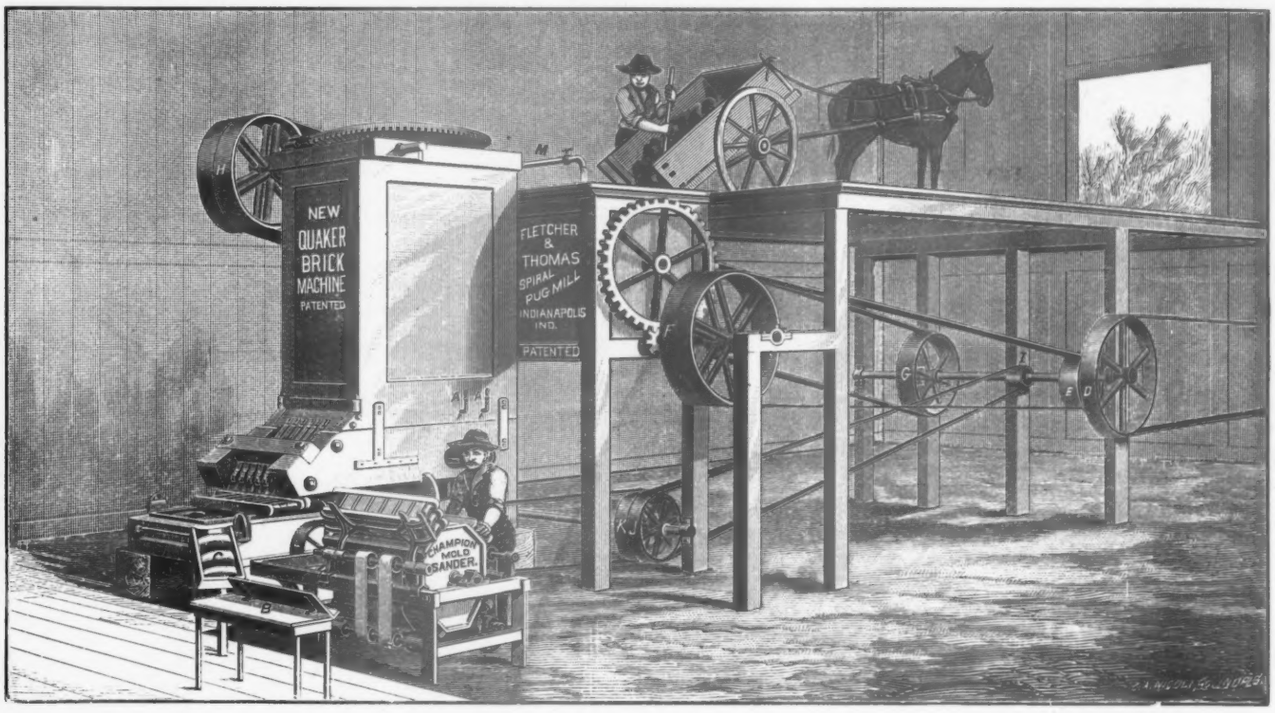


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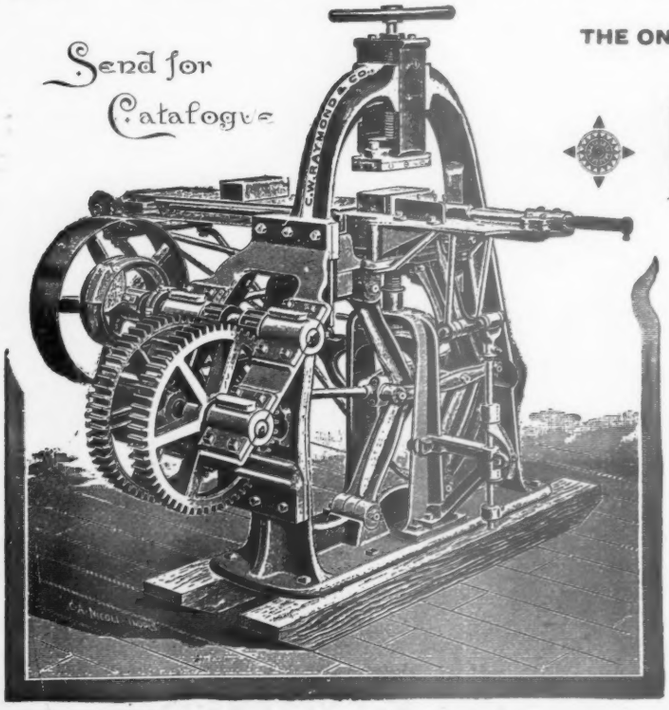


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